The Micro-X X-ray Imaging Spectrometer

Completed Technology Project (2014 - 2018)

Project Introduction

I am currently pursuing the development of a high resolution X-ray imaging spectrometer for my graduate research, via my participation in the Micro-X collaboration. Micro-X is a rocket borne spectrometer, using Transition Edge Sensors to achieve a spectral resolution that is orders of magnitude better than that of previous experiments. Transition Edge Sensors are held in a superconducting transition so that when a photon causes a small increase in temperature, there is a significant rise in resistance, providing very sensitive thermometry in this range. Upon launch, we will be able to use this instrument to probe the composition and dynamics of supernova remnants. The superior resolution of Micro-X will enable various atom emission lines to be resolved in the spectrum, from which the abundances and velocities of atomic species can be determined. This will allow us to gain insights into the makeup and dynamics of the products of supernovae. The completion of this project will represent a step forward in instrumentation, improving on the detectors that are available for X-ray astrophysics. The integration of the detectors into the entire flight system involves significant work with cryogenics and suborbital rocket systems, which are also relevant subjects of interest. In addition to the importance of this project in developing space instrumentation, it will also provide a great opportunity for me to continue my training as a scientist so that I will be able to work on further challenges in space instrumentation in the future.

Anticipated Benefits

This apparatus would enable us to measure the fraction of an incoming signal coming from an X-ray source that consists of polarized light. Once we have developed this polarimeter, we will be able to use its measurements to explore the stellar structures responsible for the polarization. For example, the X-ray radiation from neutron stars is expected to be polarized because of their strong magnetic fields and polarization measurements could help to investigate the structure of those magnetic fields. X-ray radiation from black holes is also expected to be polarized because of both electron scattering and gravitational effects, and energy dependent polarimetry will allow us to distinguish between the two.

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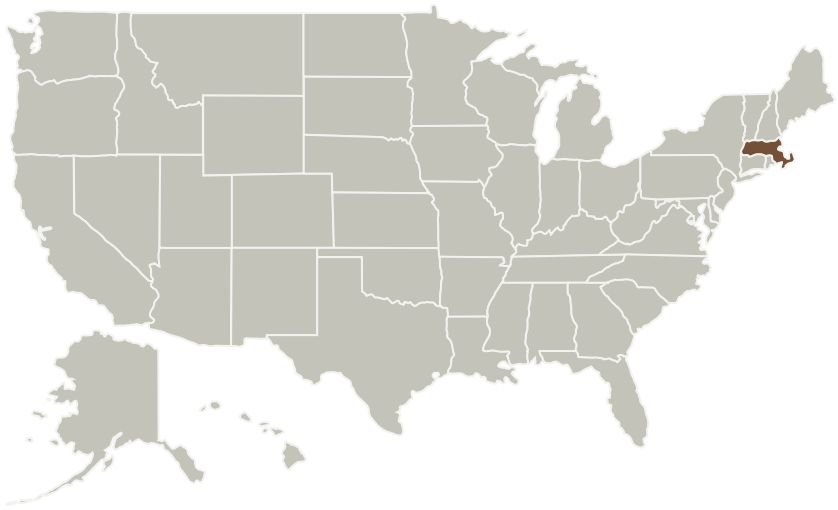
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Massachusetts Institute of Technology(MIT)	Lead Organization	Academia	Cambridge, Massachusetts

Primary U.S. Work Locations
Massachusetts

Project Website:

https://www.nasa.gov/directorates/spacetech/home/index.html

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Massachusetts Institute of Technology (MIT)

Responsible Program:

Space Technology Research Grants

Project Management

Program Director:

Claudia M Meyer

Program Manager:

Hung D Nguyen

Principal Investigator:

Claude Canizares

Co-Investigator:

David Goldfinger

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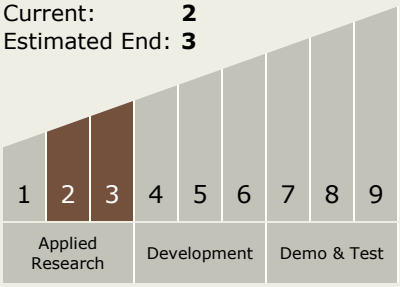
Technology Maturity (TRL)

Start: **2**
Current: **2**
Estimated End: **3**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.1 Detectors and Focal Planes

Target Destination

Outside the Solar System